PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students to excel in research or to succeed in Remote Sensing and Geomatics profession through global, rigorous post graduate education.

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve Remote Sensing and Geomatics problems.

III. To train students for gaining knowledge on concepts and applications leading to modelling of earth resources management using Remote Sensing and Geomatics.

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate Remote Sensing and Geomatics issues to broader social context.

V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve Remote Sensing and Geomatics problems.
3. Graduate will demonstrate an ability to analyze and interpret data.
4. Graduates will be fully equipped with concepts, methodologies and applications of Remote Sensing and Geomatics Technology.
5. Graduates will demonstrate an ability to visualize and work on multidisciplinary tasks.
6. Graduate will demonstrate skills in handling instruments, software tools, techniques and modeling while using Remote Sensing and Geomatics Technology.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.
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<td>Microwave Remote Sensing Laboratory</td>
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## PROFESSIONAL ELECTIVES (PE)

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<td>1.</td>
<td>RG7001</td>
<td>Airborne and Terrestrial Laser Scanning for Large Scale Mapping</td>
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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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OBJECTIVES:
- This course aims at providing the necessary basic concepts of a few statistical methods and apply them to various engineering problems.

UNIT I  ESTIMATION THEORY  12

UNIT II  TESTING OF HYPOTHESIS  12
Tests based on Normal, t, $X^2$ and F distributions for testing of means, variance and proportions – Analysis of $r \times c$ tables – Goodness of fit.

UNIT III  CORRELATION AND REGRESSION  12
Multiple and Partial Correlation - Method of Least Squares - Plane of Regression - Properties of Residuals - Coefficient of Multiple Correlation - Coefficient of Partial Correlation - Multiple Correlation with total and partial correlations - Regression and Partial correlations in terms of lower order coefficients.

UNIT IV  DESIGN OF EXPERIMENTS  12
Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V  MULTIVARIATE ANALYSIS  12

OUTCOME:
- It helps the students to have a clear perception of the power of statistical ideas, tools and would be able to demonstrate the applications of statistical techniques to problems drawn from industry, management and other engineering fields.

REFERENCES:
OBJECTIVE:
- To introduce basics and concepts of aerial photography, acquisition and mapping from aerial photographs using different types of stereo plotters

UNIT I  INTRODUCTION TO PHOTOGRAMMETRY  9

UNIT II  TRANSFORMATIONS  9
Coordinate systems for Photogrammetry - Map projections, Datums and conversions- 2D Coordinate transformations-Collinearity and Space resection-Analytical stereomodel and relative orientation- Three dimensional Coordinate transformations

UNIT III  PHOTOGRAMMETRY AND MAPPING  9

UNIT IV  DIGITAL IMAGE HANDLING  9

UNIT V  DP PROCEDURES AND APPLICATIONS  9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall
- Acquire knowledge about photogrammetry principles, methods and products generation strategies in both Analytical and digital photogrammetry system.
- Understand the problem related to generation of products and solving them.

REFERENCES:
OBJECTIVE:
- The objective of this course is to familiarize about the principles of remote sensing, data acquisition and analysis of satellite data.

UNIT I PHYSICS OF REMOTE SENSING

UNIT II PLATFORMS
Orbit elements – Types of orbits – Motions of planets and satellites – Launch of space vehicle – Orbit perturbations and maneuvers – Escape velocity – Types and characteristics of different remote sensing platforms – Sun synchronous and geo synchronous satellites.

UNIT III OPTICAL SENSORS
Classification of remote sensors – selection of sensor parameters - resolution concept - Spectral, Radiometric and temporal resolution – Quality of images in optical systems – Imaging mode – Photographic camera – Opto-mechanical scanners – Pushbroom and whiskbroom cameras – Panchromatic, multi spectral, hyperspectral scanners – Geometric characteristics of scanner imagery - Earth resource satellites operating with optical sensors- Landsat, SPOT, IRS, WorldView

UNIT IV DATA RECEPTION AND DATA PRODUCTS

UNIT V DATA ANALYSIS

OUTCOMES:
On completion of this course, the student shall be able to
- Acquire knowledge about the principles and physics of Remote sensing and data acquisition.
- Get familiarized with various data analysis techniques.

REFERENCES:
OBJECTIVES:
- Expose the students with concepts of cartography as major components of input and output related to cartography.
- To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.
- To expose the concept of quality and design of cartographic outputs in open GIS environment.

UNIT I  FUNDAMENTALS OF CARTOGRAPHY AND GIS  9

UNIT II  GIS DATA MODELS AND DATA INPUT  9

UNIT III  RASTER AND VECTOR DATA ANALYSIS  9

UNIT IV  NETWORK ANALYSIS AND SURFACE ANALYSIS  9
Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – DEM, DTM - Point data to Surface interpolation – DEM Representation - Applications

UNIT V  DATA OUTPUT AND WEB BASED GIS  9

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the student shall
- Acquire knowledge about cartographic principles, spatial data models and spatial analysis.
- Understand the cartographic outputs in open GIS environment.

REFERENCES:

RG7111 REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY L T P C 0 0 4 2

OBJECTIVE:
- This course will facilitate the students to have hands on experience on different steps of visual interpretation of satellite images & photographs and digital interpretation of photographs.

REMOTE SENSING EXERCISES
1. Map reading - Survey of India Topo sheets. 4
2. Preparation of Base Map from Survey of India Topo sheets 4
3. Preparation of Land use/land cover map using Satellite Data / Aerial Photograph. 4
4. Preparation and analysis of spectral signatures using handheld spectroradiometer for (a) Vegetation 4 (b) Soil 4 (c) Water 4

PHOTOGRAMMETRY EXERCISES
1. Testing stereovision with test card and Stereoscopic acquity 4
2. Mirror stereoscope- base lining and orientation of aerial photographs 4
3. Use of parallax bar to find the height of point 4
4. Scale of vertical photographs and Photo interpretation 4
5. Orientations using digital photogrammetric workstation 4
6. ATM using small blocks – Part I 4
7. ATM using small blocks – Part II 4
8. DEM, DSM, DTM and Orthogeneration 4
9. Feature Extraction by Stereoplotting and Monoplotting 4

TOTAL : 60 PERIODS

OUTCOME:
- On completion of this course, the student shall be able to acquire skills to carry out the Lab Exercises independently on visual interpretation of satellite images and digital processing of aerial photographs.
OBJECTIVES:
- The exercises are designed to give practical exposure to the students to data input, data storage, data analyses and data output capabilities of a standard GIS software.
- It also adds skills in mapping techniques and map outputs.
1. Rectification and Spatial Referencing of Digital Map
2. Onscreen Digitization and Database Creation
3. Projection and Reprojection of spatial data
4. Data Conversion – Vector to Raster, Raster to Vector
5. Populating Attribute data base and querying on attribute data
6. Generation of DEM: from contours, spot heights, GRID and TIN, Isometric mapping
7. Vector Analysis – Buffering, Overlay and Network analysis, flood mapping
8. Raster Analysis – Measurement - Arithmetic overlaying, Logical overlaying, Class interval selection, choropleth maps
9. Map Output - Bar charts, Pie charts and symbols
10. Map compilation
11. Modelling spatial variability
12. Weighted theissson polygon and districting
13. Customisation and scripting

TOTAL: 60 PERIODS

OUTCOME:
On completion of this course, the student shall be able to
- Acquire skills to carry out the Lab Exercises independently on spatial information system analysis and customisation.

OBJECTIVE:
- To impart the knowledge of Microwave Remote sensing and its applications.

UNIT I    PASSIVE MICROWAVE REMOTE SENSING  9

UNIT II    ACTIVE MICROWAVE REMOTE SENSING  9
UNIT III PHYSICS OF MICROWAVES

UNIT IV PLATFORMS, SENSORS AND DATA PROCESSING
Airborne, Space borne and Indian missions, Modes of Acquisition, Data products and selection procedure, SAR Image Processing software - Measurement and discrimination – Header extraction – Slant range to ground range – Multi-looking from SLC – Filtering technique - Geometric correction, Factors affecting geometrical correction – Backscattering coefficient – speckle processing – Image Interpretation, SAR Image Fusion.

UNIT IV SPECIAL TOPICS

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
• Understand concepts of passive and active microwave system
• Gain knowledge in the principles of Microwave image analysis and interpretation
• Understand the various application domains of microwave satellite data
• Gain exposure to Interferrometry and Polarimetry concepts

REFERENCES:

RG7202 PROGRAMMING FOR SPATIAL DATA PROCESSING

OBJECTIVE:
• The objective of the course is to make the students to understand the concepts of OOPS, C++ Programming, MATLAB, IDL and VISUAL BASIC
UNIT I  CONCEPTS OF OOPS AND INTRODUCTION TO C++  9+6

UNIT II  C++ PROGRAMMING  9+6
Classes and Objects – Member Functions – Private and Public Member function – Nesting of Member Functions – Array of Objects – Pointer to Members – Constructors – Destructors – Type Conversions - Inheritance – File Modes – File Pointers – Random Access – Error Handling - Exercises

UNIT III  PROGRAMMING USING MATLAB  9+6
Basics- Syntax, operators, data types, array indexing and manipulation - Two and three-dimensional plots, images, animation, visualization - Program files, control flow, editing, debugging – GUI Building

UNIT IV  PROGRAMMING USING IDL  9+6

UNIT V  GIS CUSTOMISATION PROGRAMMING USING VISUAL BASIC  9+6
Accessing databases with the Data Controls – ADO Object Model – ODBC and data access Objects – ODBC using DAO and Remote Data Objects – Data Environment and Data Report – ActiveX Controls – GIS Customisation – Case studies

TOTAL (L:45 + T:30) :75 PERIODS

OUTCOME:
- Understanding the concepts of OOPS, C++ Programming, MATLAB, IDL and VISUAL BASIC in spatial data processing.

REFERENCES:

RG7203  SATELLITE IMAGE PROCESSING  L T P C
3 0 0 3

OBJECTIVE:
- The objective of the course is to describe about the procedure of satellite data acquisition and analysis.

UNIT I  FUNDAMENTALS  9
Satellite systems and data – acquisition - storage - orbits – Data formats – Data products – Image processing system – factors to be considered- Image display systems – Image sampling and quantization - Basic relationship between pixels.
UNIT II  SENSOR AND DATA MODEL  9
Sensor model – pixel characters - Image formation – Histogram -Types- Uni-variate & multi-variate
image statistics – spatial statistics – Image registration and ortho rectification - Geometric and
radiometric correction - noise models.

UNIT III  IMAGE ENHANCEMENTS  9
Spectral signatures – Image characteristics, feature space scatterogram- point, local and regional
operation – contrast, spatial feature and multi image manipulation techniques - Fourier transform -
principle component analysis - Optimal Rotation Transformation – Scale-space transform, wavelet
transform. multi-image fusion

UNIT IV  INFORMATION EXTRACTION  9
Training sits - Supervised, Unsupervised and Hybrid classifiers -- Baye’s Theorem – parametric
Classification - -Decision tree – other Non - parametric classifiers - sub-pixel and super-pixel
classification – Hyper-spectral image analysis – Accuracy assessment.

UNIT V  IMAGE ANALYSIS  9
Pattern recognition - boundary detection and representation - textural and contextual analysis -
decision concepts: Fuzzy sets - evidential reasoning - Expert system - Artificial Neural Network –
Case studies

TOTAL: 45 PERIODS

OUTCOME:
• On completion of this course, the student shall be able to Get familiarized about various
image enhancement and image processing techniques.

REFERENCES:
  2. Robert Shcowwebgerdt, Remote sensing models & methods for image processing, 3 rd

RG7211  MICROWAVE REMOTE SENSING LABORATORY  L T P C
        0 0 4 2

OBJECTIVE :
• To provide the exposure for the students with hands on experience into the Microwave
Image Processing Using softwares

  1. Reading, displaying and header extraction of SAR images and to Generate
     Multilook Images.  4
  2. Geocoding with Dem and without DEM  4
  3. Speckle Filtering Techniques and Backscatter extraction  4
  4. Visual Image Interpretation and SAR Image fusion with Optical data  4
  5. Scattering Matrix and Scattering properties retrieval  8
  6. Polarimetric Classification  8
  7. Interferometric processing-Base line estimation and Registration  4
  8. Interferogram Generation and Phase values extraction  4
9. Phase unwrapping and Interferogram Interpretation. 4
10. Altimetry Processing- To import and display from Netcdf format 4
11. Correction methodologies and Sea surface height calculation 4
12. Scatterometry- reading and displaying the backscatter values 4
13. Retrieval of Wind parameters from backscatter values. 4

TOTAL :60 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Geocode the SAR images and to perform Filtering
- Analyse the polarimetry and interferometry microwave data
- Phase Unwrap the image for interpretation
- Process the scatterometer and altimeter data

RG7212 SATELLITE IMAGE PROCESSING LABORATORY

OBJECTIVES:
- This course will facilitate the students to have hands on experience on different steps of satellite image processing using various softwares.

EXERCISES:
1. Reading and Displaying satellite data from BIL, BSQ and BIP Formats
2. Generating False Colour Composite (FCC)
3. Extracting area of Interest (AOI)
4. Generating Histogram of various bands
5. Georeferencing the base image
6. Geometric correction of satellite image
7. Enhancement using Band ratio and NDVI
8. Enhancement using different Filtering techniques
9. Enhancement using Image Fusion
10. Principal Component Analysis (PCA)
11. Fourier analysis
12. Unsupervised Classification
13. Supervised Classification
14. Classification using Neural Network and Fuzzy Logic
15. Accuracy Assessment and Change detection study

TOTAL: 60 PERIODS

OUTCOME:
- Understanding different steps involved in satellite image processing.
RG7311  INDUSTRIAL TRAINING  L T P C  0 0 0 1

OBJECTIVE:
- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Remote Sensing and Geomatics in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.

SYLLABUS:
The students individually undertake training in reputed Industries during the summer vacation for a specified period of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOME:
- Students are trained in tackling practical field/industry orientated problems related to Remote Sensing and Geomatics.

RG7312  PROJECT WORK (PHASE I)  L T P C  0 0 12 6

OBJECTIVE:
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:
The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOME:
- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.
OBJECTIVE:
- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze the data and discuss the results, and make conclusions.

SYLLABUS:
The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOME:
- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

RG7001 AIRBORNE AND TERRESTRIAL LASER SCANNING FOR LARGE SCALE MAPPING

OBJECTIVE:
- To provide exposure to LiDAR mapping and its applications

UNIT I LASER AND SPACE BORNE LASER PROFILERS 9

UNIT II AIR BORNE LASER SCANNERS 9

UNIT III LISAR DATA PROCESSING 9

UNIT IV LIDAR DATA MANAGEMENT AND APPLICATIONS 9
UNIT V TERRESTRIAL AND BATHYMETRIC LASER SCANNER

Terrestrial Lidar: Static and Mobile (Vehicle Mounted) LiDAR -Terrestrial LASER Scanner Specification – Applications of Terrestrial LASER Scanning –Bathymetric LASER Scanner – Specification – Depth of Penetration: Secchi Depth – Applications of Bathymetric LASER Scanner

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the components of Airborne Laser Scanning System
- Plan for Airborne Laser Scanning data Acquisition
- Understand the concepts for generating DEM from Digital Surface Model by filtering
- Get exposed to various domain applications of Airborne Laser Scanner data

REFERENCES:

RG7002 DISASTER MANAGEMENT AND GEOMATICS APPLICATIONS

OBJECTIVE:
- To teach about the various principles involved and also the various mitigation to be adopted during the disasters.

UNIT I DISASTER PRINCIPLES
Disaster - Concepts and principles - Classification —— Causes, characteristics and effects of various types of natural and manmade disasters – Global scenario – vulnerability profile in India – Institutional frame work for disaster management - Role of government administration and NGOs - International disaster assistance – Sharing technology and technical expertise

UNIT II LONG TERM MITIGATION MEASURES

UNIT III PREPAREDNESS, RESPONSE AND RECOVERY

UNIT IV SAFETY RATING OF STRUCTURES
Structural safety of Hill Slopes, Dams, Bridges, Hospital, Industrial structures – planning seawalls and groynes - Cyclone shelter projects and their implications – Disaster resistant construction practices - Low cost housing for disaster prone areas
UNIT V  REMOTE SENSING AND GIS FOR DISASTER MANAGEMENT


TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the fundamentals and measurements of disaster management
- Gain knowledge in concepts of long term mitigation measures
- Gain exposure to various space based input for disaster management
- Understand the use of spatial data for emergency planning

REFERENCES:

RG7003  ELECTRONIC SURVEYING

OBJECTIVES :
- To understand the working of Total Station and GPS equipment and solve the surveying problems.

UNIT I  FUNDAMENTALS OF TOTAL STATION AND GPS

UNIT II  ELECTROMAGNETIC WAVES
Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature - pressure transducers.

UNIT III  ELECTRO OPTICAL AND MICRO WAVE SYSTEM
UNIT IV  GPS SATELLITE SYSTEM  9
GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT V  GPS DATA PROCESSING  9
GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data -data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic, pure Kinematic and Real time kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- use of different softwares.

OUTCOMES:
On completion of this course students shall be able to
- Understanding the concepts of Electromagnetic waves and impact of Refractive Index.
- Work with Electro optical and microwave Total Station and understand error sources.
- Understand the advantages of electronic surveying over conventional surveying methods
- Understand the working principle of GNSS , it”s components, signal structure, and error sources
- Understand various GNSS surveying methods and processing techniques used in GNSS observations
- Familiarise various areas of GNSS applications and new developments.

REFERENCES:

RG7004  GEODESY  L T P C
3 0 0 3

OBJECTIVE:
- To understand the concept of geodetic surveying and solve the geodetic problems.

UNIT I  FUNDAMENTALS  9
Definitions, classifications, applications and problems of geodesy. Historical development and organization of geodesy. Reference surfaces and their relationship, Engineering, lunar and planetary geodesy, Geodetic control(Horizontal and vertical)-Standards, methods and computations.

UNIT II  GEOMETRIC GEODESY  9
Basics-Geodetic,Geocentric, Reduced Spheroidal latitudes and their relationship. coordinates in terms of reduced, geodetic and geocentric latitude. Radius of curvature in the meridian &prime vertical and their relationship. Mean Radius of curvature at any azimuth. Length of the meridian arcs and arcs of parallel and area of trapezium on the spheroid. Curves on the spheroid, properties of geodesic and Everest spheroid. Natural or Astronomical coordinate system, Geodetic or Geographical coordinate system, Rectangular or Cartesian coordinate system and relationship between them. Curvilineral coordinate system. Deflection of vertical, spherical excess. Astrog-geodetic method of determining the reference spheroid.
UNIT III  PHYSICAL GEODESY

UNIT IV  GEODETIC ASTRONOMY

UNIT V  GEODETIC COMPUTATION
Rectangular and Polar co-ordinates. First and Second geodetic problem. Similarity and Helmert’s transformation. Point determination by Intersection, Resection and Arc Section.

OUTCOMES:
On completion of this course, the student shall be able to
- Understanding of Geodetic surfaces and interrelationship
- Acquire knowledge of Gravity measurements and their use in determination of elevation
- Understand the relationship between astronomical observations and geodetic parameters
- Understand principles involved in computing of Coordinates using Geodetic Measurements.

REFERENCES:

RG7005  GEOMATICS IN ENVIRONMENTAL MONITORING AND MODELLING
OBJECTIVE:
- To understand the various remote sensing and GIS technological applications in the field of Environmental Engineering.

UNIT I  SATELLITE FOR ENVIRONMENTAL MANAGEMENT
UNIT II WATER QUALITY MANAGEMENT

UNIT III AIR QUALITY AND NOISE MANAGEMENT

UNIT IV SOLID WASTE MANAGEMENT

UNIT V GLOBAL PROSPECTIVE AND CLIMATE CHANGE
Prevention and Control measures – Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status - case studies - Definitions- Climate, Climate system, climate change – Drivers of Climate change – Characteristics of climate system components - Green house effect – Carbon cycle - case studies

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Acquire knowledge of various components of environment and assessment of their quality
- Gain exposure to current and future satellite missions used for environmental assessment and modeling

REFERENCES:
OBJECTIVE:
- Promoting open source software is basic for research and providing cost effective solutions. The students shall equip with concepts and uses of Open source GIS facilities.

UNIT I INTRODUCTION 6+6

UNIT II DATABASE 6+6
File database : SQLite - Non spatial data – creation of tables views, triggers – SQL queries – RDBMS : PostgreSQL - client server connection - creation of tables views, triggers Grant and Revoke privileges – SQL queries. Spatial data model - Spatial data creation, querying, topological functions, spatial analysis on SQLite with SpatiaLite and on PostgrSQL with PostGIS

UNIT III BASIC GIS 6+6
Introduction on QGIS environment - various plugins supported – data handling capabilities – vector data formats supported – Data capture editing techniques - selecting, attribute querying and spatial querying – styling map – import and export data – connecting web data and external databases – raster data handling - calculating geometries measuring the elements - Coordinate Reference Systems conversions - preparing map layout

UNIT IV ADVANCED GIS 6+6

UNIT V IMAGE PROCESSING AND GPS 6+6
GRASS image processing – preprocessing - Radiometric transformations - image enhancements - image ratios – Principle component transformation – image fusion – unsupervised and supervised classification – segmentation. GPS: RTKLIB - Post processing - RINEX Converter - Plot Solutions and Observation Data - Downloader for GNSS Products and Data

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the important of Open source technology in GIS and various options available in its implementation.
- Acquire skills in using open source software along with the principles of handling licenses and source code modification.

REFERENCES:
OBJECTIVE:
- The objective of the course is to impart knowledge about universe, solar system, planetary atmosphere and planetary geology. The students will be exposed to various Remote Sensing Applications to planetary science.

UNIT I   UNIVERSE AND SOLAR SYSTEM  
Origin of Universe - Big Bang, Steady state and Inflationary hypothesis, Illustris model, Solar System - planets, satellites, asteroids, meteorites and comets and internal differentiation of the planets; general features of Terrestrial planets.

UNIT II   EARTH AS A REFERENCE MATERIAL  
Geology and geophysics of terrestrial planets: mars, venus and mercury; Jupiter, Uranus and Saturn and their satellites; physical properties, composition, mineralogy and petrology of the Moon.

UNIT III   PLANETARY ATMOSPHERE  
Exo-and Endogenic processes associated with origin and internal evolution of planets – planetary volcanism, craters, impact of cratering processes, mineralogy and petrology; thermal, seismic and magnetic properties, and chronological techniques.

UNIT IV   REMOTE SENSING TECHNIQUES APPLICABLE TO PLANETARY GEOLOGY  
Approaches to remote sensing analysis of the composition of planetary surfaces, applications derived from interaction of electromagnetic radiation (X-ray, gamma-ray, visible, near-IR, mid-IR, radar) with geologic materials.

UNIT V   PAST, PRESENT AND FUTURE PLANETARY EXPLORATION MISSIONS  
Analyses and Interpretation of data gathered through various missions: identification of surface and morphological features.

TOTAL : 45 PERIODS

OUTCOMES:
- On completion of this course, the student shall gain knowledge about remote sensing applications on universe, solar system, planetary atmosphere and planetary geology.

REFERENCES:

RG7008 REMOTE SENSING AND GEOMATICS FOR AGRICULTURE AND FORESTRY

OBJECTIVE:
- The content of this course enable the students to understand the application potentialities of remote sensing data separately and in combination with GIS techniques for Agriculture and Forestry.

UNIT I CROPS ACREAGE AND YIELD ESTIMATION

UNIT II SOILMAPPING

UNIT III DAMAGEASSESSMENT

UNIT IV FORESTRY
UNITV

CLIMATIC IMPACT OF AGRICULTURE AND FORESTRY

9


TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

• Understand the concepts involved in mapping of crop acreage and yield estimation
• Understand the principles space based input for crop damage assessment
• Gain skills in various applications of Forestry and sustainable watershed management

REFERENCES:

6. David H, White, S. Mark Howden, Climate Change: Significance for Agriculture and Forestry,

RG7009

REMOTE SENSING AND GEOMATICS FOR URBAN PLANNING AND MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES:

• To introduce the concepts of urban and regional planning
• To explore the use of the geospatial technology in advanced analysis in planning.

UNIT I

FUNDAMENTALS

9

Concepts of Urbanization and Urban Areas - concept of regions - formal and functional regions - census classification of urban areas - Planning Goals: Natural Resources Management; socio-economic management and infrastructure planning - Planning physical structures and functional domains - data and information for urban and regional planning by Remote Sensing - Planning goals for urban areas and regions.

UNIT II

URBAN INVENTORY AND MAPPING

9

Digital and image records of the Urban areas and Regions – classification of settlement patterns and structures – Segmentation of Built-up areas – Classification algorithms – Inventory of resources and measurements - Land use/ Land cover mapping – Deduction of sprawl, renewal and morphological changes – resolution of RS data in feature extraction and object delineation - mapping resources, developments and demography by choropleth and isopleth techniques - high resolution remote sensing data in urban analysis..
UNIT III  URBAN LANDUSE PLANNING AND MANAGEMENT  9

UNIT IV  URBAN TRANSPORTATION AND INFRASTRUCTURE PLANNING  9
Site specific GIS: Housing development, parks and social facilities planning- Utility Planning and Asset Management – urban and regional transportation corridors - wholesale and retail trade interactions - commuting-Classification of traffic – Optimum route and plans / shortest path – Alignment planning – Traffic and flow management – Accident analysis – case studies.

UNIT V  URBAN MODELLING TECHNIQUES  9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course students shall be able to
• Gain knowledge of urban and regional planning concepts, the use of geomatics technology in planning and management in urban areas and regions.
• Familiarize with case studies, inputs from Remote Sensing and GIS
• Get exposure in modelling in urban land use and its forecasting.

REFERENCES:

RG7010 SATELLITE METEOROLOGY L T P C 3 0 0 3

OBJECTIVE:
• To impart knowledge in Concepts in Meteorology, Radio and Satellite Meteorology and its Applications

UNIT I  GENERAL CONCEPTS IN METEOROLOGY  9
UNIT II  RADIO METEOROLOGY  9

UNIT III  SATELLITE METEOROLOGY  9

UNIT IV  METEOROLOGICAL APPLICATIONS  9

UNIT V  GLOBAL METEOROLOGICAL APPLICATIONS  9
Global and subglobal events – tracking of large weather system – Cloud motion vector – Dvorak’s techniques of Cyclone Intensity estimation - T-phi and other climatic charts - T number and current intensity No. – Applications to storm surge estimation - Satellite soundings – Global Warming – Sealevel changes and Consequences.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to

- Understand the concepts of Meteorology and various application areas of Meteorology.
- Gain knowledge on Radio and Satellite meteorology
- Acquire knowledge about various climatic charts

REFERENCES:
OBJECTIVE:
- The objective of the course is to make the students understand the concepts of Artificial Neural Network, Fuzzy logic and Genetic algorithms and also their application in Geomatic.

UNIT I  SOFT COMPUTING AND ARTIFICIAL NEURAL NETWORKS  9

UNIT II  FUZZY SYSTEMS  9

UNIT III  NEURO-FUZZY MODELLING  9

UNIT IV  GENETIC ALGORITHM  9

UNIT V  SOFT COMPUTING AND CONVENTIONAL AI  9
AI Search algorithm-Predicate calculus –Knowledge acquisition and representation - rules of interface - Semantic networks-frames-objects-Hybrid models – Geomatic applications

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to apply the techniques such as Artificial Neural Network, Fuzzy logic and Genetic algorithms for geomatic applications.

REFERENCES:
OBJECTIVE:
- To provide complete understanding of the concepts of Spatial Data Modelling

UNIT I  MODELLING SPATIAL PROBLEMS  9
Introduction - Need for Spatial models- Conceptual model for solving spatial problems- steps involved , Types of Spatial Models- Descriptive and Process models- Types of Spatial Models- Descriptive and Process models - Types of Process models - Creating Conceptual models - Site Suitability model

UNIT II  RASTER MODELLING  9
Understanding Raster Data set - Composition of Raster Dataset Coordinate space and Raster Dataset - Discrete and Continuous data - resolution - Raster encoding - Representing Features in Raster data set - Assigning attributes.

UNIT III  SPATIAL ANALYSIS  9
Understanding spatial analysis - Operators and Functions - Local , focal, zonal, global and application functions - surface analysis: slope, hill shade, contour and hydrologic analysis - mapping distance: shortest path - mapping density - cell statistics - neighbourhood statistics - reclassification

UNIT IV  CREATING SURFACE MODELS  9
Introduction - creating raster surface from points - interpolating a raster surface - creating TIN surface vector data - building TIN - creating a TIN from a raster- creating a raster from a TIN

UNIT V  GPS DATA PROCESSING  9
Analyzing Surfaces - Understanding the shape of a surface - calculating slope, mapping contours - deriving contour lines from a surface - calculating area and volume

TOTAL : 45 PERIODS

OUTCOME:
- Students will gain thorough knowledge on the concepts of Spatial Data Modelling.

TEXTBOOK:

REFERENCE:
OBJECTIVE:
- To make the post graduate students understand principles, processes and applications of thermal and hyper spectral remote sensing for earth resources.

UNIT I FUNDAMENTALS OF THERMAL REMOTE SENSING  9
Radiation science basics - Thermal radiation principles, thermal interaction behavior of terrain elements, thermal sensors and specifications – MUST (Medium Scale Surface Temperature Missions) infrared sensors and radiometers - aerial thermal images - Image characters, spatial and radiometry- sources of image degradation –radiometric and geometric errors and correction – interpretation of thermal image

UNIT II THERMAL IMAGE AND INTERPRETATION  9

UNIT III FIELD AND IMAGE SPECTROMETRY  9

UNIT IV HYPERSPECTRAL IMAGE ANALYSIS  9

UNIT V HYPERSPECTRAL IMAGE APPLICATIONS  9
Application to lithology, mineral exploration – agricultural crop systems – stress detection, plant production, vegetal bio physics and bio chemistry, soil moisture , soil characteristics, degradation status - forestry canopy characters, ecosystem, forest health, biodiversity, Gap dynamics, environmental and resource management.

TOTAL 45 PERIODS

OUTCOMES:
On completion of this course, the student shall be able to
- Understand the principles and properties of Hyper spectral and Thermal Remote Sensing.
- Acquire skills in analysing Thermal and Hyperspectral Remote Sensing data for various thematic mapping and its applications.

REFERENCES:
OBJECTIVE:
- This course provides skills in learning a set of scripts and their applications for providing web based services using GIS technology.

UNIT I | INTRODUCTION ON HTML | 6+6

UNIT II | CASCADING STYLE SHEET (CSS) | 6+6
The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds – Manipulating text - Margins and Padding - Positioning using CSS.

UNIT III | JAVA SCRIPT | 6+6
Data types and Variables - Operators, Expressions, and Statements -Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form handling and validations.

UNIT IV | PHP | 6+6

UNIT V | GEOSERVER | 6+6

TOTAL (L:30+T:30) : 60 PERIODS

OUTCOME:
- On completion of this course, the student shall be able to write scripts for web technology programming for GIS.

REFERENCES: